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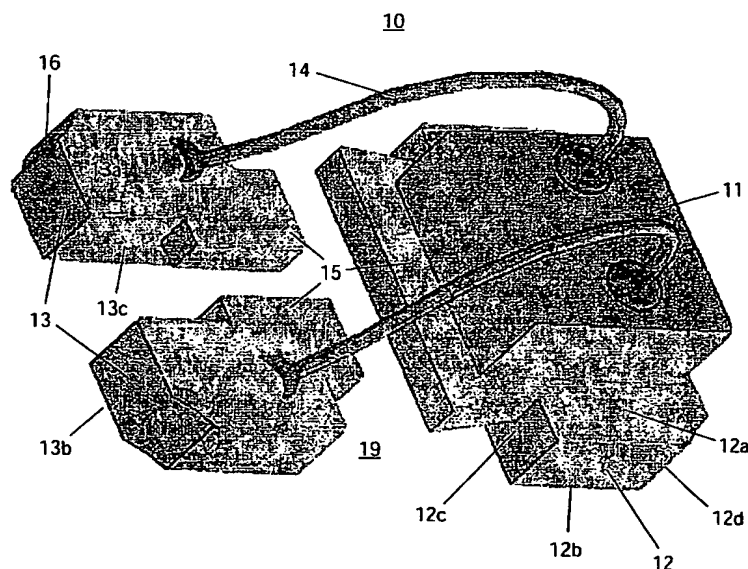
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[Continued on next page]

(54) Title: **QUAD FLAT NON-LEADED PACKAGE COMPRISING A SEMICONDUCTOR DEVICE**

(57) Abstract: A semiconductor package is proposed. The semiconductor package includes a discrete semiconductor chip on a die pad; a plurality of bond pads situated next to the chip and formed with a plurality of connecting mechanisms and an encapsulant for encapsulating the chip and the pads. In a preferred embodiment the die pad and/or the bond pads comprise means for vertically and laterally interlocking the pads to the encapsulant. The interlocking means of the bond pads and the die pad significantly enhance the bonding strength between the pads and the encapsulant for preventing delamination or cracking, so that quality and reliability of the quad flat non-leaded semiconductor package comprising a discrete can be assured.



ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,  
SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM,  
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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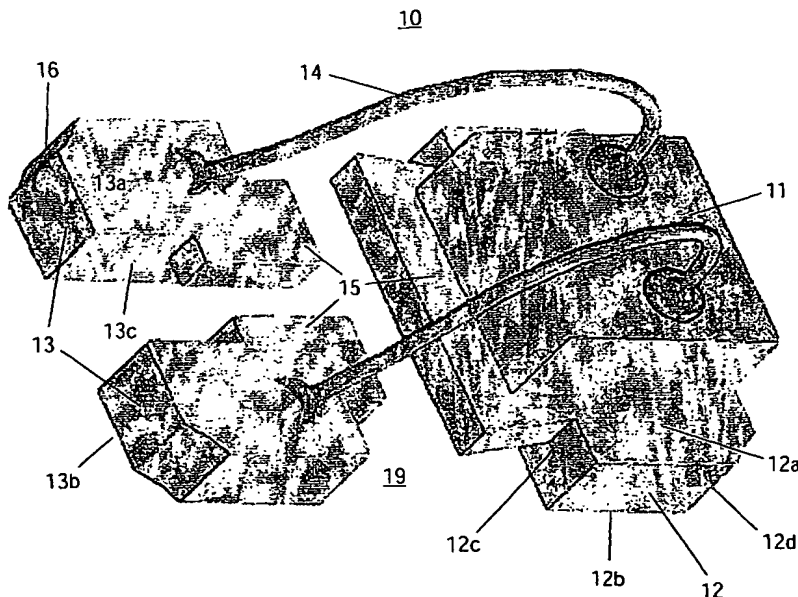
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GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,  
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,  
MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD,  
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UZ, VC, VN, YU, ZA, ZM, ZW.

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IPC 7 H01L23/31 H01L23/495

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 794 572 A (MATSUSHITA ELECTRONICS CORP) 10 September 1997 (1997-09-10) abstract; figures 1,2,7,8,14,17 column 2, line 53 - column 6, line 11 column 13, line 1 - line 44 claims 1,16	1-5
X	US 6 201 292 B1 (HITOMI YOICHI ET AL) 13 March 2001 (2001-03-13) abstract; figures 4,14,18 column 1, line 40 - column 3, line 41 claim 1	1-5
X	US 2002/063257 A1 (WANG BILY) 30 May 2002 (2002-05-30) abstract; figures 2,4,5,8 page 1, paragraph 24 claim 1	1
A		2-5
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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 1999, no. 02, 26 February 1999 (1999-02-26) -& JP 10 313082 A (SANYO ELECTRIC CO LTD), 24 November 1998 (1998-11-24)	1
A P,X	abstract -& US 2002/119603 A1 (HYODO HARUO ET AL) 29 August 2002 (2002-08-29) abstract; figures 7-9 page 2, paragraph 27 - page 3, paragraph 32 page 6, paragraph 90 - paragraph 91 -----	2-5 1

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0794572	A	10-09-1997	EP 0794572 A2	10-09-1997
			JP 3209696 B2	17-09-2001
			JP 9298256 A	18-11-1997
			US 6187614 B1	13-02-2001
			US 5977613 A	02-11-1999
US 6201292	B1	13-03-2001	JP 10335566 A	18-12-1998
			JP 11040720 A	12-02-1999
			JP 11111749 A	23-04-1999
			US 6025640 A	15-02-2000
US 2002063257	A1	30-05-2002	US 6300674 B1	09-10-2001
JP 10313082	A	24-11-1998	US 2002119603 A1	29-08-2002
			US 6410363 B1	25-06-2002
US 2002119603	A1	29-08-2002	JP 10313082 A	24-11-1998
			US 6410363 B1	25-06-2002